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PART 2: BUENA PARK SCHOOL DISTRICT PUTS LANGUAGE AND COMMUNICATION AT THE HEART OF MATHEMATICS EDUCATION

Cognitively Guided Instruction emphasizes meaning over form and helps build mathematical understanding through conversation

Buena Park, CA — Language and mathematics go hand in hand in the second year of Cognitively Guided Instruction (CGI) training for all Buena Park School District teachers and principals. The quiet math classroom of yesteryear has become a humming, interactive laboratory, where student partners work through practical math applications and share strategies. And while they may not yet recognize that viewing a problem through multiple lenses creates a stronger mathematics foundation, they do find the paradigm a lot more fun.

At its core, CGI lessons build on a student's intuitive understanding of math: They solve word problems in a way that makes sense to them, and they communicate these strategies to a partner. Teachers then listen to these conversations and select work samples to share that surface key mathematical ideas, sometimes addressing common errors and other times elucidating new ways to approach the question. Ultimately, research shows that students' ability to explain their own thinking and discover math principles through conversation greatly enhances their understanding of the subject.

At the heart of this approach to math is what may feel like its opposite**:** language.

Given the isolated, compartmentalized nature of the traditional math classroom, the interdependence between math and language may seem surprising. Indeed, the basic notion of math as its own language is not new. For decades, students have learned that the word "combine," for example, can directly be translated into the mathematical "plus" sign. However, this formulaic approach often leads students to learn math operations without understanding their context or meaning. The CGI approach to math, on the other hand, is built on the fundamentals of language, because the process of verbalizing a math strategy leads to greater comprehension and out-of-the-box thinking than memorizing just one "correct" process.

The first-grade students at Corey Elementary School love solving math problems that feature the names of classmates or adults at their school, and the subject of today's question is Mr. Kim, the acting principal: *Mr. Kim bought markers for summer school. He bought 8 boxes of markers, with 10 markers in each box, and 4 extra markers. How many markers did Mr. Kim buy?*

Dr. Jody Guarino, the mathematics guru at the Orange County Department of Education, projects this question on a smart board and leads a cohort of teachers through a morning training; soon, they will head over to a classroom to try out the lesson with students. By the end of this summer, close to 70 teachers and principals across the district will have completed 45 of the district's 90-hour commitment to CGI professional development.

In the classroom, Dr. Guarino uncovers just the first line of the math problem for a group of eager first graders: *Mr. Kim bought markers for summer school.* "Now turn and talk to your partner about Mr. Kim. What do you think this story is about?" she asks. This simple question helps students to slow down and understand the context of the math problem, rather than jumping in too quickly and trying to randomly add or subtract whatever numbers they encounter. "If the student tries to solve the problem by adding 8 plus 10 plus 4, they clearly did not understand the story and the question," explains Dr. Guarino. "The story has to come first."

Line by line, the students dissect the question with their partners; digest the meaning of the vocabulary ("What is the meaning of 'extra'?" or "What does the 8 mean in the story?"); and draw out and solve the question of Mr. Kim and his markers on their pieces of scratch paper. On the side, Dr. Guarino urges the teachers not to simplify the words in the math problem for the students, but rather to give them access to more language by discussing and using it. "All students are language learners, whether English is the student's first language or not," she reminds the teachers, "and the students need opportunities to develop their communication and language skills."

To extend the marker question further, one of the teachers in the cohort asks a boy named Edgar: "If you had 10 boxes of 10 markers instead of 8 boxes of 10 markers, how many markers would you have?" Without pause, Edgar responds: "100." As a first grader, he has not yet learned the multiplication symbol, but after working through this story about the markers and the math of this particular problem, he intuitively knows that if 8 tens is 80 markers, then 10 tens must be 100 markers. Through this process, Edgar has developed a deep understanding of place value, which is a skill that the state standards call for in second grade. Next year, when he is tasked with learning his multiplication tables, Edgar will already

understand the concept of multiplication through the power of storytelling and conversation that he is experiencing with CGI.

A study from the Harvard Business Review found that math anxiety begins as early as first and second grade for both boys and girls, when almost half of all students say they are "moderately nervous" to "very, very nervous" about math. CGI helps defuse this anxiety and build confidence through language, demystifying math by literally making it a topic of conversation. Even the youngest math students discover that they can learn from their mistakes and be mathematicians.

The way teachers engage with students to elicit their thinking can also make a significant difference in the way students feel about math and whether they enjoy and succeed in the subject. When teachers ask positive, open-ended questions and listen to the answers, students internalize that they are capable, and that their ideas are worth listening to. The outcome of these interactions once again demonstrates the power of language. For example, questions like "Can you explain?" and "Why does that work?" can loosen the tongue of a reluctant student, unlike negative questions that emphasize a student's deficits, such as "Why didn't you" or "Is there a more efficient way?" A student may come to understand more "efficient" methods in time by looking at peer samples and making connections, but the most important factor is that the student engaged with and solved the problem, whether using a standard method or not.

Ultimately, if students need to rethink an approach, they know that it is best to return to the story. And with CGI math, the story leads to a happy ending.

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